

**COURSE DATA****Data Subject**

|                      |                 |
|----------------------|-----------------|
| <b>Code</b>          | 33951           |
| <b>Name</b>          | Food Toxicology |
| <b>Cycle</b>         | Grade           |
| <b>ECTS Credits</b>  | 6.0             |
| <b>Academic year</b> | 2021 - 2022     |

**Study (s)**

| <b>Degree</b>                                  | <b>Center</b>                         | <b>Acad. Period</b> | <b>year</b> |
|--|---------------------------------------|---------------------|-------------|
| 1205 - Degree in Human Nutrition and Dietetics | Faculty of Pharmacy and Food Sciences | 3                   | Second term |

**Subject-matter**

| <b>Degree</b>                                  | <b>Subject-matter</b> | <b>Character</b> |
|--|-----------------------|------------------|
| 1205 - Degree in Human Nutrition and Dietetics | 16 - Food toxicology  | Obligatory       |

**Coordination**

| <b>Name</b>               | <b>Department</b>  |
|---------------------------|--|
| FERNÁNDEZ FRANZÓN, MÓNICA | 265 - Prev. Medicine, Public Health, Food Sc.,Toxic. and For. Med. |
| FERRER GARCIA, EMILIA     | 265 - Prev. Medicine, Public Health, Food Sc.,Toxic. and For. Med. |
| JUAN GARCIA, ANA          | 265 - Prev. Medicine, Public Health, Food Sc.,Toxic. and For. Med. |

**SUMMARY**

The subject of food toxicology (33951) is a subject of mandatory third-degree course of Human Nutrition and Dietetics, which is taught in the Faculty of Pharmacy, University of Valencia. This course provides the current curriculum for a total of 6 ECTS credits are given twice a year.

The main objective of the subject of Food Toxicology is the toxicological formation with the purpose of guaranteeing to the population safe foods. For this, knowledge will be provided on several blocks: General toxicology including the phases of the toxic phenomenon, the evaluation of toxicity and risk.



Food intoxications, that is, pathologies caused by natural toxins, biological contaminants, chemical pollutants as inorganic and organic, natural or synthetic and toxic derivatives. Computer and laboratory practices will be carried out where analytical methods will be applied to determine toxic concentrations in food and interpret the results obtained.

## PREVIOUS KNOWLEDGE

### Relationship to other subjects of the same degree

There are no specified enrollment restrictions with other subjects of the curriculum.

### Other requirements

To study toxicology, knowledge of a number of basic concepts of biology, physiology, chemistry and biochemistry are needed. These concepts are part of the contents of the subjects taught during the previous courses in the Graduate.

## COMPETENCES (RD 1393/2007) // LEARNING OUTCOMES (RD 822/2021)

### 1205 - Degree in Human Nutrition and Dietetics

- Practise the profession with respect for other health professionals and acquire skills to work in teams.
- Communicate effectively, both orally and in writing, with people, with health or industry professionals and with the media, knowing how to use information and communication technologies, especially those related to nutrition and lifestyles.
- Recognise the need to maintain and update professional competence, with particular emphasis on independent and lifelong learning of new facts, products and techniques in the field of nutrition and food, and on motivation for quality.
- Know, judge and know how to use and apply the sources of information related to nutrition, food, lifestyles and health.
- Know about the microbiology, parasitology and toxicology of food.
- Acquire basic training for the research activity, be able to formulate hypotheses, collect and interpret information for problem solving using the scientific method, and understand the importance and the limitations of scientific thought in the field of health and nutrition.
- Know the basics of occupational toxicology.
- Know about the various toxicokinetic processes (absorption, distribution, metabolism and excretion).
- Know the general mechanisms of toxic action.
- Know the procedures for the evaluation of toxicity.
- Know the sources of exposure, pathophysiology, toxic effects and mechanism of action of toxic substances present in foodstuffs.



- Know about the harmful effects of toxic substances in food, mechanism and signs of these effects.
- Collaborate in the prevention of food poisoning and know the safety limits of toxins to ensure safe food to the population.
- Know aspects related to the assessment and characterisation of the toxicological risk of potentially toxic substances in food.
- Know the methods most commonly used for the analysis of toxic substances in food.
- Conocer y manejar las fuentes de información básicas relacionadas con la Toxicología alimentaria.

## LEARNING OUTCOMES (RD 1393/2007) // NO CONTENT (RD 822/2021)

By undertaking this course, students should acquire the following skills and abilities:

- Sound knowledge on basic toxicology.
- Ability to pose and solve basic toxicological problems, relating the chemical and structural properties of the toxins.
- Skill and ability to solve toxicological problems
- Knowledge of toxicology through the opportunities that Internet provides, and ability to relate the presence of toxic foods with the effects.
- Training students to perform experimental work. Contact laboratory for toxicological analysis to begin to motivate students who want to continue the scientific and research activity

## DESCRIPTION OF CONTENTS

### 1. General Toxicology: Toxicity and concepts

Unit 1. Food Toxicology: Introduction. Historical evolution. Bibliography.

Unit 2. Toxicological concepts. Intoxication classification. Classification of toxic substances.

Unit 3. Dose-effect relationships and dose response. Uncertainty factors

### 2. Phases of toxic action. Toxicokinetics

Toxicokinetics

Unit 4. Phases of toxic action. Exposure phase. Pathways for xenobiotics. Passing mechanisms of the toxins through biological membranes. Absorption.

Unit 5. Distribution, fixation and excretion of toxins.

Unit 6. Toxicokinetics. Compartmental models.

Biotransformations of toxins.

Unit 7. Biotransformations of toxins. Phase 1 reaction: oxidation, reduction, hydrolysis and hydration.

Unit 8. Reactions Phase 2: Sulfation, glucuronidation, acetylation, methylation, conjugation with glutathione and amino acids.

Mechanisms of toxicity. Factors that modify toxicity

Unit 9. Mechanisms of toxicity. Apoptosis and necrosis.

Unit 10. Mechanisms of toxicity. Nonspecific and specific toxicity. Reversible and irreversible toxicity reactions.



Unit 11. Immune reactions. Food Allergies

Unit 12. Factors that modify toxicity. Factors that depend on the individual: genetic factors. Environmental factors.

### **3. Evaluation of the toxicity.**

Unit 13. Procedures for toxicological evaluation. General effect studies: Acute, subchronic and chronic toxicity tests.

Unit 14. Studies of specific effects: carcinogenesis, mutagenesis, teratogenesis and effects on reproduction, skin, eyes and behavior.

Unit 15. Alternative methods. Vitro assays. Biological substrates. Indicators of toxicity.

### **4. Food Toxicology**

Natural toxics

Unit 16. Marine food: Intoxications by molluscs and fish.

Unit 17. Toxics in vegetable products. Anti-nutritive substances. Superior mushrooms.

Biological contaminants

Unit 18. Toxic effects of biological contaminants. Food intoxications. Botulism, Bacillus cereus and Staphylococcus aureus.

Unit 19. Food toxin infections: salmonellosis, listeriosis, toxin infection by Escherichia coli, Clostridium perfringens toxicity and campylobacteriosis.

Chemical contaminants

Unit 20. Inorganic chemical contaminants. Metals (I): Lead and mercury.

Unit 21. Metals (II): arsenic, cadmium and aluminum.

Unit 22. Toxic effects of fluorides, nitrates and nitrites.

Unit 23. Mycotoxins. Most frequent foods involved as sources of exposure. Factors that favor pollution. Prevention and legislation.

Unit 24. Organic chemical contaminants. Pesticides: classification and toxicity. Organochlorine pesticides and related structures (dioxins, furans and polychlorinated biphenyls).

Unit 25. Organophosphorus pesticides, carbamates and bipyridyl salts. Mechanisms of action and toxic effects. Presence in foods. Preventive measures.

Unit 26. Residues of veterinary drugs. Classification. Mechanisms of action and main toxic effects. Toxic risk assessment.

Unit 27. Food additives. Definition and classification. risk assessment

Unit 28. Food supplements. Vitamins Minerals Other supplements. Adverse effects.

Toxic derivatives

Unit 29. Toxics formed during the processing, preparation and storage of food. Pyrogenic compounds. Non-pyrolytic compounds. Compounds formed by alkaline treatments.

Unit 30. Toxics derived from the heating and oxidation of fats and oils. Toxics formed by degradation or reaction of contaminants.



Food carcinogens

Unit 31. Food carcinogens. Diet-cancer.

Toxicological risks evaluation

Unit 32. Risk analysis. Risks evaluation. Characterization of risks. Risk management.

## 5. Food Toxicology practices

Good Laboratory Practice. Standard analytical food toxicology analysis. Analysis of toxic xenobiotics and as a means of quality control. Types of analysis. Toxicological analysis techniques. Evaluation of analytical data. Toxicology report

1. Safety in handling chemicals.
- 2 .- Management of Databases in Toxicology
- 3 .- Determination of nitrate in vegetables by visible spectrometry
- 4 .- Determination of herbicides in water by liquid chromatography
- 5 .- Determination of pesticides by solid phase extraction and gas chromatography.
- 6 .- Determination of nitrite in meat by visible spectrometry.
- 7 .- Determination of fluoride in water by potentiometer

## WORKLOAD

| ACTIVITY                                     | Hours         | % To be attended |
|--|---------------|------------------|
| Theory classes                               | 38,00         | 100              |
| Laboratory practices                         | 15,00         | 100              |
| Seminars                                     | 2,00          | 100              |
| Tutorials                                    | 2,00          | 100              |
| Development of group work                    | 9,00          | 0                |
| Preparing lectures                           | 76,00         | 0                |
| Preparation of practical classes and problem | 5,00          | 0                |
| <b>TOTAL</b>                                 | <b>147,00</b> |                  |

## TEACHING METHODOLOGY

The development of the course will be structured as follows:

Theoretical classes the professor offers the student a global vision of the subject, as well as the necessary information to understand the contents of the subject. In these classes the student is encouraged to search for additional or complementary information, guiding him/her in the use of the appropriate bibliographic sources. In order to follow the class, the student is recommended to review in advance the material that the professor leaves in the virtual classroom.





Specialized group tutoring sessions. They will be organized in small groups of students with the purpose of orienting the students and determining the functioning of the course. It will be the ideal way for students to raise any doubts or questions that may arise during the development of the syllabus.

Practical laboratory sessions. They will be carried out in small groups and attendance is mandatory. The student's work is directed step by step, so that he/she acquires manual skills in the laboratory and solves by him/herself the problems that are posed. On the last day of practice, the students present the results obtained to the rest of the group and the toxicological interpretation of the results is discussed. At the end, they must hand in a notebook-memory of the same.

This block includes a computer practice, in which the student is oriented to search for toxicological information on the Internet and access to useful databases in Toxicology.

Seminars/workshops. A group work will be carried out on a topic proposed by the professor in order to expose it to the rest of the class and to generate a later debate. A written script will be given to the classmates before the exposition. The group is personally supervised by the teacher periodically and guides them in the search for bibliographic sources and in the critical analysis of the data found in these sources. The professor advises on the general approach of the work, so as to encourage the student's capacity for work, synthesis and research.

In both theoretical and practical sessions, we will work with the Sustainable Development Goals (SDGs) using examples related to the content of the subject; in addition, related topics will be proposed for the coordinated seminars. This is intended to know and approach the points and challenges that are addressed in different SDGs in the subject of food toxicology and that will allow students of the Degree of Human Nutrition and Dietetics to have a critical view, and make a reflection of aspects that in their professional future will be necessary. Of the 17 Sustainable Development Goals, the following SDGs related to food toxicology will be addressed: SDG2, SDG3, SDG4, SDG5, SDG6, SDG12, SDG13.

## EVALUATION

### Subject evaluation system

The realization of internships, seminars and tutorials is mandatory to overcome the subject. A minimum mark of 4/10 is required in each of the assessed teaching activities to be compensated with the mark of the rest.

The course is passed when specific material skills are acquired (minimum overall mark 5/10)  
For the evaluation of the theoretical contents, an exam will be taken to evaluate the theoretical contents of the subject. The mark obtained will be 65% of the overall qualification of the subject.

The practical laboratory classes will be evaluated by means of the attendance, the accomplishment of a written exam, which will have the same convocation as the exam of the theoretical contents, besides the presentation of the memory of practices and proposed exercises. The internship qualification will represent 20% of the final qualification.



The evaluation of the tutorials will represent 5% points. This qualification will take into account the resolution of the proposed tasks, different to the laboratory practices and seminars, and tutorial assistance. Non-attendance (without justified cause), will imply a zero in the evaluation section corresponding to tutorials.

The preparation and presentation of seminars will represent 10% of the final mark. Both the content, structure and expression of the written work and the capacity for synthesis and clarification in the oral presentation will be evaluated.

If the subject is failed in the second call, the laboratory practices will not be repeated during the following two courses. Repeaters must attend and complete the tutorials.

Those students who do not pass the subject in the first call will be given the grade corresponding to seminars for the Juliol call.

Furthermore, in order to evaluate the learning process, the teacher will directly assess the student's attitude and his/her participation in both theoretical and practical classes.

## REFERENCES

### Basic

- Repetto M, Repetto G. Toxicología Fundamental. 4 ed, Díaz de Santos, Madrid, 2009.
- Klaassen CD, Watkins JB. Casarett y Doull fundamentos de Toxicología. Mc Graw-Hill Interamericana, Madrid, 2005.
- Ballantyne B, Marrs TC, Syversen T. General and Applied Toxicology. 3rd ed. Wyley & Sons, West Sussex, 2009.
- Calvo Carrillo MC, Mendoza Martínez E. Toxicología de los alimentos. Mc GrawHill Interamericana Editores, 2012.
- Revista del Comité Científico de la Agencia Española de Seguridad Alimentaria y Nutrición.
- Revista Española de Toxicología (AETOX).
- Páginas web de interés  
<http://www.aecosan.msssi.gob.es/AECOSAN/web/home/index.htm>  
<http://www.efsa.europa.eu/>  
<http://busca-tox.com>



### Additional

- Cameán A, Repetto M. Toxicología Alimentaria. Díaz de Santos, Madrid, 2006.
- Hayes AW Principles and Methods of Toxicology. Taylor & Francis, London, 2009.

## ADDENDUM COVID-19

**This addendum will only be activated if the health situation requires so and with the prior agreement of the Governing Council**

### 1. Contents

The contents initially included in the teaching guide are maintained

### 2. Workload and time planning of teaching

The workload for the student, derived from the number of credits, is maintained, but the methodology of the activities changes with respect to the conventional teaching guide, due to the current situation which makes it necessary to adopt a hybrid teaching model

### 3. Teaching methodology

- Theoretical teaching: it will be carried out through synchronous sessions (synchronized videoconferences in BBC, or other technology indicated by the Center) and face-to-face sessions. The distribution of students will be made by groups, so that 50% will be in the classroom of the Faculty while the other 50% will be connected online, alternating their attendance by weeks. The class will always follow the schedule (date and time) approved by the Board of the Center.
- Tutorials: All of them will be in accordance with the dates indicated in the course calendar
- Coordinated or non-coordinated seminars: All of them will be held according to the dates indicated in the course calendar
- Practical classes: They will be face-to-face and according to the course calendar, but with the appropriate modifications to comply with the CoVid19 safety regulations:
  - Limiting the capacity of the laboratories to 50% by establishing shifts in each group.
  - The materials for these sessions will be previously uploaded to the virtual classroom (practice booklet, presentations with explanations or voice-overs, links, explanatory videos of the techniques/methods used).
  - Students will deliver problems and activities related to the practices through the virtual classroom "homework" option.

In case of a total confinement state, all face-to-face teaching will be done online.





#### **4. Evaluation**

The exam will be taken in person and in the terms indicated in the teaching guide, if the evolution of the pandemic allows it. Only if this is not possible, the evaluation will be done through the virtual classroom with online tasks or questionnaires with single or multiple choice questions, which can be complemented with short questions and / or sometimes through an oral exam via videoconference.

The relative weight of theory, practicals and seminars is maintained as indicated in the teaching guide.

